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Population Structure, Foraging Behavior and Daily Movements of Certain Sonoran Desert Birds

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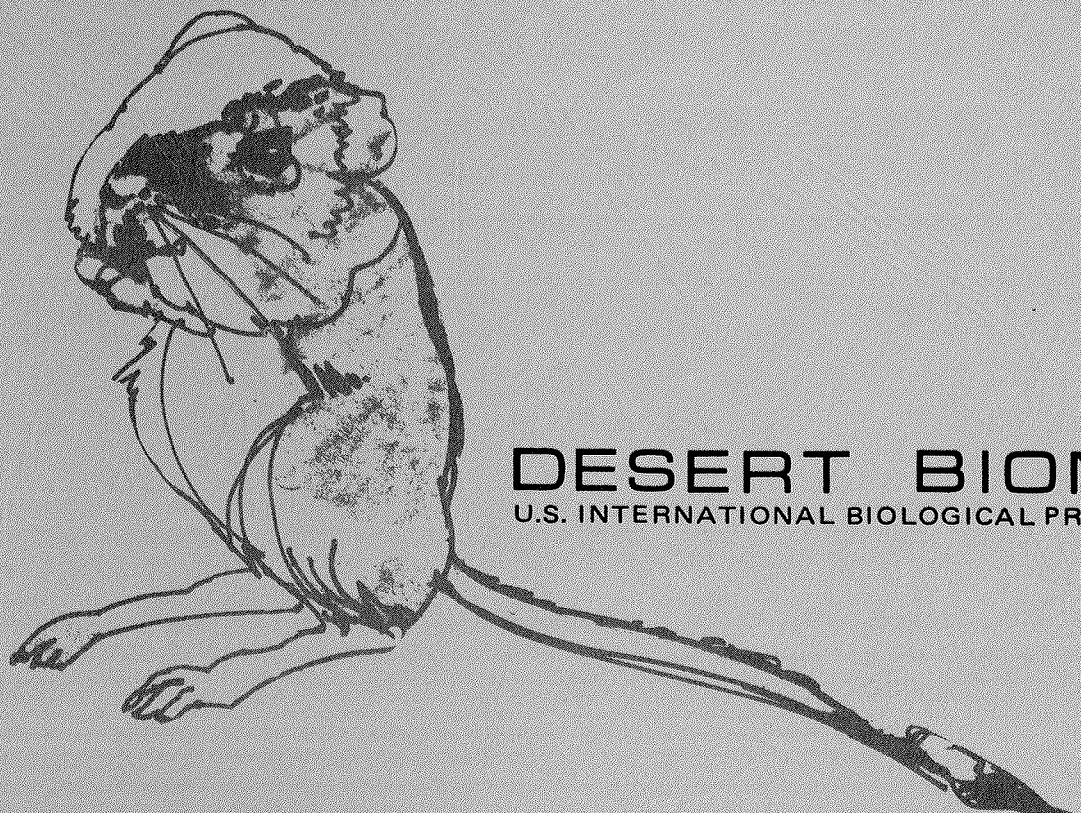

DESERT BIOME
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1972 PROGRESS REPORT

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ABSTRACT

This study investigated the role of birds in the desert ecosystem at Tucson IBP sites.

Birds nested from February to September; on the Silverbell site about 70% of all nests constructed were begun before the onset of summer rains, but some species did not nest before the rains began. An adult breeding population of 7.5 kg (22 species) on a 20 ha plot of the Silverbell site produced a fledgling biomass of 4.6 kg; 41% of all nests that contained at least one egg fledged young and 32% of all eggs laid produced fledglings. Nesting failures were due primarily to predation (37%) and cowbird parasitism (22%). On the Santa Rita 20 ha plot, 15 species nested after June 15, 39% of all eggs laid produced fledglings, and a total fledgling biomass of 3.3 kg resulted. Fledging success was highest in late July and August and coincided with the peak in insect abundance. It does not appear that the drought in the first five months of 1972 had an adverse effect on nesting success. Wintering sparrows consumed mostly seeds of *Aristida, Panicum* and *Paspalum*.

INTRODUCTION

Unlike most other vertebrates, birds are highly mobile. The species diversity and abundance may change abruptly from one season to another, and from one breeding season to the next. The breeding population may be suddenly augmented by additional bird species and numerous individuals when habitat conditions are exceptionally favorable. Or species may leave an area when drought reduces the food resources. Some birds forage far from their nesting sites. Wintering flocks of migrant sparrows may be of major importance as primary consumers in some years, but be virtually absent in other years. This project investigated demographic patterns, growth rates, dispersion, movements, and foraging behavior in an effort to establish the relationship between the annual cycle of birds and the variables in the desert environment.

In this second year of the project, the Cactus Wren and Curve-billed Thrasher have continued to receive special emphasis. These are abundant permanent residents, and study of them provides insight into the importance of birds in energy transfer in the desert. The most intensively studied community in 1972 was the palo verde (*Cercidium*)-saguaro (*Cereus*) dominated Silverbell site. Study on the Santa Rita site was restricted to the summer nesting season. Mesquite-grassland dominates the Santa Rita site.

OBJECTIVES

The basic objective has been a general ecological study of the bird community in the Sonoran Desert. This report contains data on the following two objectives.

1. To determine growth and reproductive rates of birds on the Silverbelland Santa Rita sites.
2. To evaluate the importance of wintering flocks of sparrows as primary consumers and determine the foods consumed. Energy requirements will be estimated later.

The following two objectives were studied in 1972, but the data are being analyzed and will be reported in a subsequent Research Memorandum.

1. To determine the extent of movements of birds on the Silverbell site and define their foraging niches.
2. To study the foraging behavior of Curve-billed Thrashers and Cactus Wrens to determine food habits, and to determine time-energy budgets in order to estimate energy requirements.

METHODS

Data on reproductive activity (DSCODES A3URJ14, A3URJ15 and earlier A3URJ02) were collected throughout 1972 on the Silverbell site and from June 15 to the end of the breeding season on the Santa Rita site. A 20 ha plot at each site was covered as often as necessary (daily during the height of activity) in order to find nests as they were constructed and follow them until their fate was established. When nests were first found, data on nest placement were obtained, and the location of the nest plotted on a map. Individual pairs of birds were identified and their movements plotted on study area maps (not submitted through data processing). Nestlings of some species were weighed and measured to obtain growth rates (A3URJ04).

Individuals of the most abundant insectivorous species have been followed by an observer who recorded their foraging behavior (A3URJ03). Curve-billed Thrashers and Cactus Wrens have been subjected to a more comprehensive time-budget analysis (A3URJ06 and A3URJ07) at various seasons of the year. The time budget study results in relatively few minutes of data for each hour in the field because the birds are easily disturbed, even by a cautious observer. These studies also yield information on food items consumed.

In 1971, the effect of widely dispersed rains in summer upon the distribution of nesting bird species was studied. This was done by conducting a 3-minute bird census (A3URJ08 and A3URJ09) at each of 25 stations one mile apart in the Santa Rita and the Avra Valley sites. Also at each station, an 8-minute survey (A3URJ10 and A3URJ11) of bird activity was conducted, features of insect density noted, precipitation measured, and plant phenology recorded. No data from this part of the project are presented in this report; computer analysis is in progress.

In the winter of 1971-72, eighty sparrows were collected and their crops and gizzards examined to determine seeds consumed. The seeds from each bird were sorted and identified (to genus) and weighed. Efforts to determine relative abundance of foods available were unsuccessful.

On the Santa Rita site, insects were sampled at about one week intervals from July 18 to September 18. One hundred passes of a 38 cm diameter sweep net were made in grass and another 100 sweeps in mesquite boughs. Each 100 sweeps constituted a sample. The insects in each sample were weighed (both fresh and after drying in an oven), sorted by species and counted. Samples were taken at 1000 hrs (MST) on still or relatively calm days.

RESULTS

Data for the Silverbell and Santa Rita Experimental Range Sites are presented in separate sections.

Silverbell site

Table 1 (DSCODES A3URJ12 and A3URJ14) distinguishes between residents, breeding visitors, non-breeding visitors, and irregular visitors (Table prepared for Validation report). Residents are present year-around and nest on the plot. Breeding visitors are present during the nesting season, but go elsewhere during the remainder of the year. Doves that nest on the plot forage in agricultural areas to the east and find little of their food on the plot (Russell et al., 1972). Non-breeding visitors are birds that occur in numbers on the plot but nest elsewhere. Irregular visitors occur as transients. The occurrence of bird species on the 20 ha plot based on frequency of observation is tabulated in the Validation report (DSCODE A3URJ13). Although this report does not include a description of the extent of movements within the plot, Table 3 (DSCODE A3URJ14) indicates the number of pairs of each species that had territories or nested on the 20 ha intensive study plot.

Reproductive activity began in February and young in some nests were not fledged until September (Table 2, DSCODE A3URJ14). A table presenting the date and the fate of each nest is available upon request from the authors. The number of pairs of each bird species on the 20 ha plot and the results of their nesting efforts appear in Table 3. The results of reproductive efforts in terms of biomass produced are found in Table 4 (DSCODE A3URJ14). Table 5 (DSCODE A3URJ14) indicates the plants in which nests were placed, the plant height, the nest height, type of nest constructed and the fate of the nest (a more detailed table is available from the authors). The overall nesting success is presented in Table 6 (DSCODE A3URJ14) and Table 7 itemizes the causes of nesting failures.

Other data collected but not reported here are discussed under Expectations.

Table 1. Number of individuals regularly occurring each month on the Silverbell plot A3URJ12, A3URJ14, (in part)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Residents												
Gambel Quail	11	11	11	4	4	7	11	11	11	11	11	11
Gilded Flicker	5	5	5	5	8	10	7	5	5	5	5	5
Gila Woodpecker	6	6	6	6	6	9	9	9	11	6	6	6
Ladder-backed Woodpecker	2	2	2	2	2	2	3	3	2	2	2	2
Verdin	8	8	8	12	18	14	13	13	8	8	8	8
Cactus Wren	14	14	14	19	19	19	19	14	14	14	14	14
Curve-billed Thrasher	10	10	10	12	12	12	15	14	14	10	10	10
Black-tailed Gnatcatcher	10	10	10	14	14	10	10	10	10	10	10	10
Pyrrhuloxia	4	4	4	4	5	5	7	7	5	5	4	4
Brown Towhee	4	4	4	4	4	4	4	5	5	4	4	4
Rufous-winged Sparrow	2	2	2	2	2	2	2	4	4	2	2	2
Black-throated Sparrow	10	4	4	4	7	7	7	16	16	10	10	10
Breeding Visitors												
Harris Hawk	0	1	1	1	1	1	1	1	1	1	1	0
White-winged Dove	0	0	0	6	6	6	8	8	0	0	0	0
Mourning Dove	1	11	8	8	8	8	8	1	1	1	1	1
Elf Owl	0	0	4	4	4	6	8	8	0	0	0	0
Wied Crested Flycatcher	0	0	4	4	4	4	8	8	0	0	0	0
Ash-throated Flycatcher	0	1	5	3	3	3	3	3	0	0	0	0
Scott Oriole	0	0	0	2	2	2	4	4	0	0	0	0
Brown-headed Cowbird	0	0	6	6	6	6	6	6	0	0	0	0
House Finch	1	4	4	4	1	1	1	1	1	1	1	1
Purple Martin	0	0	0	2	2	2	5	5	5	2	0	0
Non-Breeding Visitors												
Sparrow Hawk	0	0	0	0	0	0	1	1	1	1	0	0
Empidonax sp.	1	1	0	0	1	0	0	0	0	0	0	1
House Wren	1	0	0	0	0	0	0	0	0	0	1	1
Mockingbird	5	5	5	2	0	0	1	0	0	5	5	5
Western Bluebird	4	4	4	0	0	0	0	0	0	0	0	0
Ruby-crowned Kinglet	4	3	3	1	0	0	0	0	0	1	4	4
Phainopepla	9	9	1	0	0	0	0	0	3	9	9	9
Logger-head Shrike	1	1	1	0	0	0	0	0	0	1	1	1
Starling	3	3	3	2	2	0	1	1	1	3	3	3
Brewer Sparrow	75	75	75	50	15	0	0	0	0	5	10	75
White-crowned Sparrow	2	6	6	2	0	0	0	0	0	0	1	2
Irregular Visitors												
Gray Vireo	0	0	0	1	0	0	0	0	0	0	0	0
Audubon Warbler	1	0	0	0	0	0	0	0	0	0	0	1
MacGillivray Warbler	0	0	0	0	0	0	0	0	1	0	0	0
Orange-crowned Warbler	0	0	0	0	1	0	0	0	0	0	0	0
Wilson Warbler	0	0	0	0	2	0	0	0	0	0	0	0
Warbler sp.	0	0	0	1	0	0	0	0	0	0	0	0
Bullock Oriole	0	0	0	0	3	0	0	0	0	0	0	0
Green-tailed Towhee	0	0	0	1	1	0	0	0	0	0	0	0
Rufous-sided Towhee	1	1	1	0	0	0	0	0	0	0	0	1

Table 2. Breeding phenology of birds on the Silberbell plot A3URJ14

Species	No. Nests	Ave. No. Eggs Per Nest	Date of First Egg	Ave. No. Fledglings Per Nest	Date of last Fledging	Percent nests Successful
Harris Hawk	1	0	-	0	-	00.0
Gambel Quail	2	?	17 Jun.	3.5	10 Jul.	100.0
White-winged Dove	4	1.5	16 May	0.5	14 Jul.	25.0
Mourning Dove	10	1.5	29 Feb.	0	-	00.0
Elf Owl	2	?	06 May	2.0	20 Jul.	100.0
Gilded Flicker	2	?	08 Apr.	2.5	07 Jun.	100.0
Gila Woodpecker	5	?	27 Mar.	2.0	04 Aug.	80.0
Wied Crested Flycatcher	2	?	06 Jun.	2.0	11 Jul.	50.0
Ash-throated Flycatcher	1	3.0	05 Jun.	0	-	00.0
Verdin	8	3.3	09 Mar.	1.9	20 Jul.	62.5
Cactus Wren	8	3.4	01 Mar.	0.6	13 Apr.	25.0
Curve-billed Thrasher	13	2.3	25 Feb.	0.8	26 Jul.	38.5
Black-tailed Gnatcatcher	14	1.0	13 Mar.	0.3	12 Apr.	07.1
Scott Oriole	1	0	-	0	-	00.0
Brown-headed Cowbird	9	1.3	09 May	0	-	00.0
Pyrrhuloxia	4	3.0	25 Mar.	1.3	04 Sep.	75.0
House Finch	2	2.5	04 Mar.	0	-	00.0
Brown Towhee	4	1.3	04 Mar.	0.2	16 Aug.	20.0
Rufous-winged Sparrow	2	1.0	26 Jun.	1.0	15 Aug.	50.0
Black-throated Sparrow	7	1.7	27 Apr.	1.3	26 Aug.	42.9
Overall		2.1	25 Feb.	0.9	04 Sep.	33.3

Table 3. Breeding species diversity on the Silverbell plot A3URJ14 (in part)

Species	Number of Pairs on 50 Acre Plot With: Territories	Nests	Eggs	Nestlings	Fledglings
Harris Hawk	1	1	0	0	1
Gambel Quail	5	2	2	2	3
White-winged Dove	4	3	3	2	1
Mourning Dove	4	4	4	2	0
Elf Owl	2	2	2	2	2
Gilded Flicker	3	2	2	2	2
Gila Woodpecker	2	2	2	2	2
Ladder-backed Woodpecker	2	2	2	2	1
Wied Crested Flycatcher	2	2	2	1	1
Ash-throated Flycatcher	3	1	1	0	1
Purple Martin	1	0	0	0	1
Verdin	5	4	4	3	3
Cactus Wren	8	7	7	6	2
Curve-billed Thrasher	6	5	5	5	4
Black-tailed Gnatcatcher	6	5	4	1	5
Scott Oriole	2	1	0	0	1
Brown-headed Cowbird	4F - 3M	-	+	0	0
Pyrrhuloxia	2	2	2	2	2
House Finch	2	2	2	1	0
Brown Towhee	3	2	2	2	1
Rufous-winged Sparrow	2	1	1	1	2
Black-throated Sparrow	12	5	3	2	4

Table 4. Productivity of birds on the Silverbell plot A3URJ14

Species	Biomass (in grams) of: Breeding Adults	Eggs*	Nestlings*	Fledglings	Gross Biomass Produced	Net Biomass Produced
Harris Hawk[1]	1563	0	0	0	0	0
Gambel Quail	678	?	0	1187	1187	1187
White-winged Dove	875	27	0	292	319	292
Mourning Dove	1050	76	45	0	121	0
Elf Owl	80	?	?	80	80	80
Gilded Flicker	416	?	?	520	520	520
Gila Woodpecker	280	?	?	700	700	700
Wied Crested GLycatcher	184	?	?	184	184	184
Ash-throated Flycatcher	56	10	0	0	10	0
Verdin	59	8	22	111	141	111
Cactus Wren	536	40	188	192	420	192
Curve-billed Thrasher	820	47	545	902	1494	902
Black-tailed Gnatcatcher[2]	55	8	0	22	30	22
Scott Oriole[3]	77	0	0	0	0	0
Brown-headed Cowbird	233	23	0	0	23	0
Pyrrhuloxia	142	19	31	178	228	178
House Finch	76	4	50	0	54	0
Brown Towhee	180	9	64	45	118	45
Rufous-winged Sparrow	31	0	0	31	31	31
Black-throated Sparrow	131	6	0	118	124	118
Total	7522	277	945	4562	5784	4562
Off plot nesting of pairs labeled 1, 2, 3.	-	2	?	1617	1619	1617

*Only eggs not hatched, and nestlings not fledged are included in these columns.

Table 5. Nest placement and success of birds on the Silverbell plot A3URJ14

Species	Nests	Plant Species	Ave. Plant Height (cm)	Ave. Nest Height (cm)	No. Nests Fledging Young
Harris Hawk	1	*Carnegiea gigantea*	762	610	0
Gambel Quail	2	Ground	0	0	2
White-winged Dove	1	*Cercidium microphullum*	762	236	0
White-winged Dove	2	*Carnegiea gigantea*	808	447	0
White-winged Dove	1	*Opuntia fulgida*	290	203	1
Mourning Dove	3	*Cercidium microphyllum*	396	158	0
Mourning Dove	1	*Cercidium floridum*	762	305	0
Mourning Dove	1	*Olneya tesota*	1067	427	0
Mourning Dove	3	*Carnegiea gigantea*	864	323	0
Mourning Dove	2	*Opuntia fulgida*	236	102	0
Elf Owl	2	*Carnegiea gigantea*	1067	762	2
Gilded Flicker	2	*Carnegiea gigantea*	899	853	2
Gila Woodpecker	5	*Carnegiea gigantea*	1201	871	4
Wied Creseted Flycatcher	2	*Carnegiea gigantea*	1219	1067	1
Ash-throated Flycatcher	1	Dead tree	457	91	0
Verdin	5	*Cercidium microphyllum*	493	193	3
Verdin	1	*Cercidium floridum*	244	114	0
Verdin	1	*Opuntia fulgida*	168	94	1
Verdin	1	*Opuntia versicolor*	147	114	1
Cactus Wren	2	*Carnegiea gigantea*	762	300	1
Cactus Wren	6	*Opuntia fulgida*	201	165	1
Curve-billed Thrasher	13	*Opuntia fulgida*	244	188	5
Black-tailed Gnatcatcher	4	*Cercidium microphyllum*	495	175	0
Black-tailed Gnatcatcher	1	*Cercidium floridum*	305	155	1
Black-tailed Gnatcatcher	9	*Phoradendron californicum*	546*	411	0
Scott Oriole	1	*Phoradendron californicum*	1067*	488	0
Pyrrhuloxia	1	*Cercidium microphyllum*	701	216	0
Pyrrhuloxia	2	*Cercidium floridum*	503	262	2
Pyrrhuloxia	1	*Phoradendron californicum*	610*	241	1
House Finch	1	Dead saguaro	366	236	0
House Finch	1	*Opuntia fulgida*	274	208	0
Brown Towhee	3	*Cercidium microphyllum*	538	155	1
Brown Towhee	1	*Olneya tesota*	686	191	0
Rufous-winged Sparrow	1	*Cercidium microphyllum*	406	150	1
Rufous-winged Sparrow	1	*Acacia gregii*	183	94	0
Black-throated Sparrow	1	*Cerdidium microphyllum*	274	112	0
Black-throated Sparrow	1	*Olneya tesota*	762	251	0
Black-throated Sparrow	2	*Acacia gregii*	249	119	2
Black-throated Sparrow	1	*Opuntia versicolor*	142	48	1
Black-throated Sparrow	1	*Phoradendron californicum*	396*	251	0

*Height of host tree

Table 6. Nesting success of birds on the Silverbell plot A3URJ14

	Number	%Producing Eggs	%Producing Nestlings	%Producing Fledglings
Nests Built	93	79.6	51.6	33.3
Nests with Eggs	74	----	64.9	41.9
Nests with Nestlings	48	----	----	64.6
Eggs Laid	161	----	49.7	31.7
Eggs Hatched	80	----	----	63.8
Fledglings	51	----	----	----

Table 7. Causes of nesting failure of birds on the Silverbell plot

	Predation	Weather	Cowbird Parasitism	Interference by Other Species	Human Interference	Infertile Eggs	Unknown
Number	22	6	13	2	7	1	9
Percent	36.7	10.0	21.7	3.3	11.7	1.7	15.0

Santa Rita Experimental Range Site

Intensive studies began on the Santa Rita site in mid-June. All nests found on the 20 ha intensive study site are summarized in Table 8 (DSCODE A3URJ15; a more detailed table may be obtained from the authors). Although the plot was not systematically searched for nests before mid-June, nine nests containing eggs were located on April 10 (Table 9). Breeding success is summarized in Tables 10 and 11 (DSCODE A3URJ15). Both the Gilded Flicker and Gila Woodpecker successfully fledged young from their nests in the single large Saguaro on the plot, but the number of eggs laid, nestlings and fledglings are estimated. Four pairs of Rufous-winged Sparrows were found, each with two fledglings. The number of eggs and fledglings in these cases are guesses. Scaled Quail young were found on the plot; it is possible that their nest was not located on the 20 ha plot. In Table 11, the 198 eggs accounted for in the upper part of the Table is matched by only 189 in the lower portion. Nine eggs in 3 nests, plus the Woodpecker and Flicker nests were started in May. In these tables nest success us based upon the number of nests that contained at least one egg. Some nests were started and abandoned before an egg was laid. Table 12 (DSCODE A3URJ15) summarizes the location of nest sites. Insects sampled with a sweep net are noted in TABLE 13 (no DSCODE). Tables submitted as a part of the Validation report on birds on Santa Rita indicate the seasonal distribution of all species recorded on the plot, their density, and biomass.

An analysis of crop and gizzard contents of 80 sparrows is presented in Tables 14, 15 and 16 (no DSCODE).

Table 8. Distribution of nesting dates in 1972 on the 20 ha Santa Rita plot from 15 June to end of breeding season

Species	No. of Nests	Total No. Eggs	Date of First Egg	Date of First Egg in Last Nest	Total No. Nestlings	Total No. Fledglings	No. of Cowbird Eggs *
Scaled Quail	1	10	1 June	---	1	---	
Mourning Dove	7	13	7 June	15 August	6	6	
Lesser Nighthawk	1	2	4 June	---	2	2	
Gilded Flicker	1	?	15 May+	---	?	2+	
Gila Woodpecker	1	?	10 May±	---	?	2±	
Verdin	2	6	8 June	13 June	6	3	
Cactus Wren	5	15	31 May	12 June	9	6	
Curve-billed Thrasher	5	15	23 May	22 June	10	8	
Black-tailed Gnatc.	1	?	20 July	---	?	0	1
Blue Grosbeak	1	1	26 August	---	0	0	
Brown Towhee	4	12	10 June	27 July	3	3	
Rufous-wg. Sparrow	44	116	11 June	20 August	54	42	6
Black-thr. Sparrow	1	1	26 July	---	0	0	

*The only cowbird egg to hatch was in a gnatcatcher nest (and it was swallowed as a nestling by a *Masticophis*).

Table 9. Bird nests found April 10, 1972, on the Santa Rita Experimental Range (20 ha) plot

Species	No. of Eggs
Roadrunner	4
Cactus Wren	3
Cactus Wren	3
Cactus Wren	4
Cactus Wren	3
Cactus Wren	3
Curve-billed Thrasher	2
Curve-billed Thrasher	2
Curve-billed Thrasher	2

Note: all nests contained eggs but the fate of these nests is unknown.

Table 10. Reproductive success and biomass produced by birds found nesting on the 20 ha study plot in the Santa Rita Experimental Range after June 15, 1972

					Biomass (in grams) of:		
Species	No. Pairs	No. Eggs†	No. of Nestlings†	No. of Fledglings†	Eggs*	Nestlings*	Fledglings
Quail, Scaled	1	(10)	(10)	7	0	100	1200
Dove, Mourning	7	13	6	6	28	0	450
Nighthawk, Lesser	1	2	2	2	0	0	60
Flicker, Gilded	1	(2)	(2)	(2)	-	-	200
Woodpecker, Gila	1	(2)	(2)	(2)	-	-	130
Verdin	2.5	6	6	3	0	16	21
Wren, Cactus	8.5	15	9	6	22	75	180
Thrasher, C.-bld.	7.5	15	10	8	30	104	448
Cowbird, B.-hd.	-	7	1	0	21	20	0
Grosbeak, Blue	1	1	0	0	3	0	0
Towhee, Brown	4	12	3	3	39	0	96
Sparrow, Ruf.-wg.	20	116	55	42	110	117	504
Sparrow, Blk.-thr.	3.7	1	0	0	2	0	0
Total	58.2	202	106	81	255	432	3289

*Only eggs not hatching and nestlings not fledging are included in these columns.
†Figures in parentheses are estimates.

Table 11. Breeding success of birds on the 20 ha study plot in the Santa Rita Experimental Range after June 15, 1972 (in percent)

Species	Eggs Hatch	Eggs Fledge	Hatched Fledged	Nests Successful	No. Eggs	No. Nests
Quail, Scaled	100	70	100	100	(10)	1
Dove, Mourning	46	46	100	43	13	7
Nighthawk, Lesser	100	100	100	100	2	1
Flicker, Gilded	-	-	-	100	--	1
Woodpecker, Gila	-	-	-	100	--	1
Verdin	100	50	50	50	6	2
Wren, Cactus	60	40	67	40	15	5
Thrasher, Curve-billed	67	54	80	60	15	5
Cowbird, Br.-hd.	14	0	0	0	7	-
Gnatcatcher, Blk.-tl.	0	0	0	0	0	1
Grosbeak, Blue	0	0	0	0	1	1
Towhee, Brown	25	25	100	25	12	4
Sparrow, Ruf.-wg.	48	36	76	36	116	44
Sparrow, Blk.-thr.	0	0	0	0	1	1
Total	52	39	76	41	198	74
June	55	30	54	26	64	23
July	41	30	73	30	73	27
August	54	52	97	58	52	19

Table 12. Nest site selection in birds breeding on the Santa Rita Experimental Range

Species	No. of Nests	Plant Species	$\bar{x}$ Plant Height (cm)	$\bar{x}$ Nest Height (cm)	% Nests Successful
White-winged Dove	1	*Opuntia fulgida*	167	121	0
Mourning Dove	7	*Prosopis*	348	216	29
Roadrunner	1	*Celtis*	305	124	?
Gilded Flicker	1	*Cereus giganteus*	610	535	100
Gila Woodpecker	1	*Cereus giganteus*	610	458	100
Verdin	3	*Cercidium*	438	167	100
Verdin	1	*Celtis*	229	159	0
Cactus Wren	9	*Opuntia fulgida*	206	172	?
Curve-billed Thrasher	8	*Opuntia fulgida*	180	129	?
Curve-billed Thrasher	1	*Opuntia spinosior*	213	151	0
Blue Grosbeak	1	*Prosopis*	432	335	0
Brown Towhee	1	*Cercidium*	380	264	0
Brown Towhee	2	*Prosopis*	420	262	0
Brown Towhee	3	*Celtis*	243	142	67
Rufous-winged Sparrow	25	*Celtis*	265	116	20
Rufous-winged Sparrow	15	*Cercidium*	343	173	13
Rufous-winged Sparrow	11	*Opuntia spinosior*	140	82	54
Rufous-winged Sparrow	3	*Opuntia fulgida*	180	147	67
Rufous-winged Sparrow	2	*Acacia greggi*	283	162	50
Rufous-winged Sparrow	1	*Lycium (?)*	167	114	100
Black-throated Sparrow	1	*Acacia greggi*	183	112	0

Table 13. Number, weight, and species diversity of insects captured in a 38cm diameter sweep net passed 100 times through grass (A) and mesquite (B) Santa Rita Experimental Range, 1972

	Sample Date†							
	18 July	25 July	1 Aug.	8 Aug.	17 Aug.	26 Aug.	6 Sept.	18 Sept.
A. Grass								
No. of species	15	46+	62	79+	125/2*	64	79	73
No. of individuals	22	121	188	484	319	331	294	257
Fresh weight (g)	0.39	1.81	3.24	3.80	3.83	2.82	4.68	2.07
Dry weight (g)	0.17	0.59	1.07	1.39	1.33	1.13	1.61	0.66
B. Mesquite								
No. of species	22	27	52	46	59	84	51	56
No. of individuals	50	64	103	103	247	526	233	136
Fresh weight (g)	1.09	1.32	1.00	3.99	1.34	2.11	1.10	0.80
Dry weight (g)	0.37	0.46	0.31	2.09	0.61	0.93	0.40	0.28

* The 125 represents insect species in 200 sweeps of the net.
† Samples were taken at 1000 hrs. (MST).

Table 14. Seed contents of sparrow crops from Santa Rita Experimental Range, winter 1971-72

Month	Number of Birds	Average Number of Seeds per Crop					
		Aristida	*Paspulum*	*Amaranthus*	*Panicum* sp.1	*Panicum* sp.2	*Setaria*
A. Brewer's Sparrow							
October	2	65.0	1.0	5.0	29.0	6.5	0.0
November	10	25.9	0.2	1.7	6.3	1.3	0.0
December	10	45.8	0.1	1.4	4.7	0.5	0.0
January	9	37.2	0.0	1.9	3.1	0.3	0.3
February	10	27.9	0.1	0.0	7.3	2.5	0.3
March	8	14.3	0.0	0.3	8.0	0.8	0.0
B. Rufous-winged Sparrow							
October	1	0.0	15.0	0.0	0.0	10.0	0.0
November	5	2.4	4.6	3.8	5.0	1.4	0.0
December	5	3.0	1.6	18.6	5.4	6.4	0.0
January	5	1.0	0.4	0.6	12.0	7.4	2.2
February	5	3.6	0.2	5.0	15.6	5.4	0.0
March	2	4.5	0.0	3.5	10.0	0.0	0.0
C. Black-throated Sparrow							
October	--	----	----	---	----	---	---
November	2	0.0	0.0	0.0	2.5	0.5	0.0
December	2	6.0	0.5	10.0	0.0	3.0	0.0
January	1	2.0	0.0	1.0	0.0	2.0	0.0
February	0	----	----	---	----	---	---
March	0	----	----	---	----	---	---

Table 15. Seed contents of sparrow crops from the Santa Rita Experimental Range, winter 1971-72

Month	Number of Birds	Average weight (g) of seeds per crop, as percent total weight seed per crop					Total seeds wt.(gm)
		Aristida	*Paspulum*	*Amaranthus*	*Panicum* sp.1	*Panicum* sp.2	
A. Brewer's Sparrow							
October	2	53.2	1.2	11.2	23.9	10.6	.0489
November	10	65.2	.62	11.9	15.7	6.2	.0159
December	10	82.4	.45	6.7	8.5	1.8	.0222
January	9	80.9	0.0	11.4	6.5	1.1	.0184
February	10	69.1	.6	0.0	17.9	12.3	.0162
March	8	58.1	0.0	3.1	32.6	6.1	.0098
B. Rufous-winged Sparrow							
October	1	0.0	52.9	0.0	0.0	47.0	.0170
November	5	10.7	30.1	45.1	2.1	11.7	.0093
December	5	4.1	3.4	70.9	7.6	17.6	.0290
January	5	3.3	1.6	5.8	40.0	49.1	.0120
February	5	7.4	.5	31.2	35.3	24.4	.0176
March	2	18.5	0.0	40.2	41.2	0.0	.0097
C. Black-throated Sparrow							
October	0	----	---	----	----	----	-----
November	2	0.0	0.0	0.0	71.4	28.6	.0014
December	2	14.8	1.8	68.2	0.0	14.8	.0161
January	1	22.8	0.0	31.4	0.0	45.8	.0035
February	0	----	---	----	----	----	-----
March	0	----	---	----	----	----	-----

Table 16. Crop contents of sparrows* from Santa Rita Experimental Range, winter 1971-72, expressed as percent of specimens containing each food type

Bird Species	October-December					January-March				Total		
	SPI-BRE	AIM-CAR	AMP-BIL	PIP-FUS	AMM-SAV	SPI-BRE	AIM-CAR	AMP-BIL	MEL-MEL	SPI-BRE	AIM-CAR	AMP-BIL
No. of Specimens	22	11	4	1	1	27	12	1	1	49	23	5
Aristida	95	45	25	100	100	96	58	100	100	96	52	40
Paspalum	18	36	25	00	00	04	17	00	00	10	26	20
Amaranthus	18	45	25	00	00	15	50	100	100	16	48	40
Panicum sp.1	82	45	50	00	00	78	75	00	00	80	61	40
Panicum sp.2	45	73	50	100	100	26	58	100	100	35	65	60
Setaris	00	00	00	00	100	11	17	00	00	06	09	00
Insects	09	18	00	100	00	04	00	00	00	06	09	00

*Species Code

SPIBRE = Brewers Sparrow
AIMCAR = Rufous-winged Sparrow
AMPBIL = Black-throated Sparrow
PIPFUS = Brown Towhee
AMMSAV = Grasshopper Sparrow
MELMEL = Song Sparrow

DISCUSSION

One of the basic objectives involves relating events in the birds' annual cycle to variables in the environment. Critical information on temperature and precipitation is not yet available. Studies emphasize the Silverbell site.

The period of mid-December, 1971, to late May, 1972, was characterized by drought. Birds on both the Silverbell and Santa Rita sites appear to have not been adversely affected by the dryness. Perhaps the heavier-than-usual rains in the fall of 1971 moderated the drought effects.

Silverbell site

Species composition and occurrence: To date, 87 species have been recorded on or immediately adjacent to the 20 ha study plot. Twelve of these species are permanent residents within the area (Table 1), 10 are regular breeding visitors, 11 are regular non-breeding visitors, and the remainder are either transitory migrants or only occasional visitors.

Timing and sequence of breeding events: The 1972 breeding season began in early February and the last young fledged in early September (Table 2). There were three peak periods of activity. The first occurred in early March and involved the major resident species plus one breeding visitor. The second, and largest, peak was in early June and resulted from the arrival of breeding visitors and second nestings by resident species. A small third peak in late July and early August was primarily due to late activity of Black-throated Sparrows and Rufous-winged Sparrows.

Breeding diversity: Twenty-two species nested, or attempted to nest, within the 20 ha plot in 1972. Seventy-eight pairs (plus four female Brown-headed Cowbirds) held territories, 53 pairs built nests, and 48 pairs laid eggs within this plot (Table 3).

Breeding biomass and productivity: A breeding biomass of 7.5 kg/20 ha produced a gross biomass of 5.8 kg/20 ha and a net biomass of 4.6 kg/20 ha within the 20 ha study plot in 1972. A few pairs had second nestings off the plot and these produced an additional net biomass of 1.6 kg/20 ha (Table 4).

Nest placement: Sixty-five percent of all nests built were distributed rather evenly between *Opuntia fulgida* (23%), *Cercidium microphyllum* (21%), and *Carnegiea gigantea* (20%). Nests placed in *C. gigantea* were the most successful (55% fledging young). The vegetation in which nests were placed averaged 205 inches in height while nest sites averaged 119 inches above the ground (Table 5).

Nesting success: Thirty-three percent of all nests built produced fledged young, while 42% of all nests in which eggs were laid produced fledged young. The major cause of nest failure was predation, mainly by snakes (Tables 6 and 7).

Santa Rita site

Timing and sequence of breeding events: Light rains in late May and early June stimulated nesting attempts by Rufous-winged Sparrow (the most abundant resident species). Not one of ten nests started in June fledged any young (Table 8). Another flurry of nesting activity began about 10 July (after more substantial rains had fallen and some were successful. All passerine birds nesting on the plot feed insects to their young. In August nests, 97% of all eggs hatching resulted in fledged young (Table 11). Our insect sampling indicated a peak about August 8 and an abundance of insects persisting to September 6 -- during the period of maximum nestling and fledgling demand (Table 13). However, Cactus Wrens and Curve-billed Thrashers are not active nesting birds at this time; they normally nest before the summer rains start.

Breeding diversity: Thirteen species nested on the plot in the summer of 1972 (Table 10); this includes all species usually nesting in the area but includes only one of the five "nomadic" species that nested in the plot after the heavy rains of 1970. A Lesser Nighthawk successfully nested on the plot in 1972 -- the first time this insectivorous species has nested there. A pair of Scaled Quail with seven half-grown young appeared on the plot in July. The nest had not been found and it may have nested off the plot but its presence emphasizes the difficulty involved in studying such secretive but common birds. In all, 58 pairs of birds held territories or nests on the 20 ha plot in summer.

Nest placement: Breeding birds generally selected rather spinescent shrubs of the most common species for their nests (Table 12). The preference of *Opuntia fulgida* for nest sites by Curve-billed Thrashers and Cactus Wrens is well known. *Celtis* is so favored by Rufous-winged Sparrows that they rarely occur where this plant is absent. Thus it is of interest that more nests placed in *Opuntia spinosior* were successful than in *Celtis*. The lack of sites for hole-nesting species undoubtedly prevents a number of species from occurring there (the Silverbell site is rich in hole-nesting species and has greater species diversity and biomass).

Nesting success: Forty-one percent of the nests containing eggs were successful (i.e., fledged at least one young bird). This figure is very close to the 42% on the Silverbell site and to success in previous years on the Santa Rita site.

Wintering sparrow flocks: In the period of late October, 1971, to March, 1972, individuals of several species of Fringillidae were collected on the Santa Rita Experimental Range in order to determine the foods they were consuming. A total of 80 birds was dissected and the contents of each crop, proventriculus and gizzard were removed (Tables 14-16). The genera *Aristida* (1-4 mm diameter), *Paspalum* (3 x 2 x 2 mm), *Amaranthus* (0.5 x 0.5 mm), *Setaria, Panicum* sp. 1 (1 x 1 x 1 mm), and *Panicum* sp. 2 (2 x 1 x 1 mm), were the samples identified.

Most of the birds examined were Brewer's Sparrows (49), Rufous-winged Sparrows (23), and Black-throated Sparrows (5). These were the most frequently encountered species in the winter of 1971-72. Brewer's Sparrows consumed almost solely seeds of *Aristida* and *Panicum*. Rufous-winged Sparrows appear to be less selective and regularly take seeds of all species except *Setaria;* the intake of *Paspalum* decreases as the winter progresses and the number of *Panicum* sp. 1 seeds increases later in the winter. Black-throated Sparrows consume seeds of several species; there may be some preference for *Panicum* sp. 2.

EXPECTATIONS

Project funding terminated 31 December, 1972. However, a considerable portion of the data collected must still be analyzed. Much of this data is presently on coding forms or in the data bank; assurances of continued support through IBP Central Office facilities and Data Processing will permit continued work on several phases of the project.

The following studies are expected to be reported on in supplementary Research Memoranda.

1. An evaluation of the reproductive characteristics of the 1971 and 1972 breeding seasons in terms of environmental variables.
2. Growth rates, weights of study site birds (DSCODE A3URJ04).
3. Foraging niches of insectivorous study site birds (DSCODE A3URJ03).
4. Bird populations and reproductive success on a creosote-bush association.
5. The effect of widely dispersed rains in summer on the distribution of breeding bird species (DSCODES A3URJ08, 09, 10, 11).
6. Time-energy budgets of Cactus Wrens and Curve-billed Thrashers (DSCODES A3URJ06, 07).
7. An analysis of habitat characteristics involved in territory selection.

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